REMARKS

Claims 1-8 and 10-15 are pending in the present Application. Applicant has amended claims 1 and 10. Applicant has also canceled claims 4 and 13. Consequently, claims 1-3, 5-8 and 10-12 and 14-15 remain pending in the present Application.

Applicant has amended claims 1 and 10 to incorporate the limitations of claims 4 and 13, respectively, reciting that each of the positions corresponds to a pixel in the display. Consequently, Applicant respectfully submits that no new matter has been added and that no new search is required.

Applicant has presented arguments hereinbelow that Applicant believes should render the claims allowable. In the event, however, that the Examiner is not persuaded by Applicant's arguments, Applicant respectfully requests that the Examiner enter the Amendment to clarify issues upon appeal.

In the above-identified Office Action, the Examiner rejected claims 1, 2 and 4 under 35 U.S.C. § 103 as being obvious in light of U.S. Patent No. 4,918,626 ("Watkins") in view of U.S. Patent No. 5,684,919 ("Foran"). The Examiner also rejected claims 3 and 5-8 under 35 U.S.C. § 103 as being unpatentable over Watkins in view of Foran in further view of U.S. Patent No. 5,872,902 ("Kuchkuda"). The Examiner also rejected claims 10-15 under 35 U.S.C. § 103 as being unpatentable over Watkins in view of Foran in further view of U.S. Patent No. 5,408,606 ("Eckart").

In the above-identified Office Action, the Examiner rejected claims 1, 2 and 4 under 35 U.S.C. § 103 as being obvious in light of Watkins in view of Foran. In response to Applicant's arguments, the Examiner stated:

> Applicant states that Watkins in view of Foran do no disclose a method and system in which the objects are rendered pixel by pixel; the examiner disagrees, because both Watkins and Foran suggest improving antialiased imaging with improved pixel supersampling using mask and raster to perform antialiasing, rendering objects pixel by pixel (Watkins, col. 8, lines 36; Foran; col. 5, line 16); in general, the system resolves priority between contending polygons at specific locations, e.g. pixels or sub-pixels, Watkins teaches determining intersection edge 18 between two polygons and a pixel 36a lying on the edge 18. Thus, it is apparent that the resolution between of pixel-by-pixel or sub-pixel by sub-pixel polygon priority between polygons contending for individual areas in a display, e.g. pixels, the system as disclosed filters the pixel data to eliminate hidden surface and accomplishing antialiasing. Foran discusses using coverage mask indicating an extent of polygon coverage within each polygon covered pixel. The image system also includes a raster system having at least one image processor for receiving pixel data for each pixel; Foran also discusses rendering objects pixel by pixel (col. 5, lines 16-23). Therefore, the combination of Foran in view of Watkins must render the scene pixel by pixel. Claim 10, the teaching of Eckart shows performing visibility and blending operations on predetermined sequences of update pixels to provide display data in raster order by numerical sequence from 0 to 8 (col. 8, lines 7-20). Therefore, the combinations of Watkins, Foran, Eckart and Kuchkuda show limitations of claims 1–8, 9-15, and the rejection is maintained.

Applicant respectfully traverses the Examiner's rejection. Independent claim 1 recites a method for generating a graphical image on a display from data describing at least one object. The display includes a plurality of positions, each of which has an area. The method recited in claim 1 includes several steps. Steps (a)-(c) include various steps performed for multiple objects, or polygons, at a current position. Steps (a)-(c) determine whether a particular object intersects the current position, provides a mask for the object at the current position and performs antialiasing for the object at the position. Step (d) repeats steps (a)-(c) for all of the remaining objects that intersect the current position. Thus, steps (a)-(d) ensure that the determination of intersection and the provision of masks are provided on a per pixel basis. Step (e) recites that the steps (a) through (d) are then repeated for other positions **after** step (d) has been performed for

the current position. Claim 1 then recites that each position corresponds to a pixel and the current position corresponds to a current pixel.

Thus, the method recited in claim 1 ensures that the determination of intersections and masks is performed pixel by pixel. In other words, the method recited in claim 1 completes determining whether any object intersects the pixel, providing masks and performing antialiasing for a current pixel, before completing these tasks for the next pixel. Thus, the method recited in claim 1 processes and renders the objects pixel by pixel, preferably in raster order. Only one pass through the data for the objects is thus required. Specification, page 18, lines 5-6. Linked lists, therefore, need not be used and the memory and resources required for linked lists are freed. Specification, page 18, lines 6-10.

In contrast, Watkins in view of Foran fails to teach a method including the recited combination of steps. Watkins in view of Foran fails to teach or suggest determining whether objects intersect a current pixel (position), providing masks for objects intersecting a current pixel, antialiasing the objects intersecting the current pixel, then performing these steps for objects intersecting subsequent pixels. Watkins thus fails to teach or suggest the combination of steps (a), (b), (d) and (e) in the manner recited.

In contrast to the method recited in claim 1, Watkins describes a system which determines intersections and masks polygon by polygon, rather than pixel by pixel. Watkins specifically states that the polygons are scan converted. Watkins, col. 8, lines 43-50. The scan conversion process determines the pixels that the polygon intersects. Watkins, col. 10, lines 43-46. This scan conversion also determines the sub-pixels within each pixel that are occupied by the polygon. Watkins, col. 10, lines 46-56. A mask indicating which of the sub-pixels are intersected by the

polygon is then provided, Watkins, col. 10, line 57-col. 11, line 5. See also, Watkins, col. 11, line 25-col. 12, line 12 (for a subsequent polygon). Using the mask, antialiasing can be performed. Once these operations are completed for a **polygon**, a subsequent polygon is scan converted. Watkins, col. 11, lines 6-13. After scan conversion, a raster subsystem places the data in raster order for depiction on a display.

Consequently, Watkins determines the pixels intersected by a polygon and provides a mask for all of the pixels intersected by a polygon (i.e. scan converts the polygon) before performing these steps for another polygon. Watkins, therefore, would not performs steps (a)-(c) and then step (d) and (e). In other words, Watkins would not perform the intersection determining and mask providing steps for all of the polygons intersecting the current pixel, then move to the next pixel. Instead, Watkins would perform the intersection determining and mask providing steps for each polygon, then moves to the next polygon. Once these steps are performed, Watkins passes the data to the raster converter. Watkins, col. 13, lines 46-51. Consequently, Watkins does not teach the steps recited in claims 9 in the order recited (e.g. step (d) depending upon steps (a),(b) and (c) and thus commencing later).

The teachings of Foran fail to remedy the defect of Watkins. Applicant agrees that Foran discusses using masks to perform antialiasing. However, like Watkins, Foran describes scan converting the polygons. The process of scan converting the polygons includes providing a coverage mask for supersampling. Foran, Abstract, lines 3-9. The coverage mask is based on the size of a supersample region (such as a pixel) and indicates the regions that a particular polygon covers. Foran, col. 3, lines 62-67. Consequently, the masks provided by the scan converter of Foran are provided polygon by polygon. This data is then transferred to the raster subsystem of

Foran, which converts the data to raster order. Foran, col. 5, lines 10-18.

Thus, like Watkins, Foran determines the intersections between a polygon and pixels and provides the appropriate mask(s) on a per polygon basis. Foran, therefore, would not performs steps (a)-(c) and then step (d) and (e). In other words, Foran would not perform the intersection determining and mask providing steps for all of the polygons intersecting the current pixel, then move to the next pixel. Instead, Foran would perform the intersection determining and mask providing steps for each polygon, then moves to the next polygon. Once these steps are performed, Foran passes the data to the raster converter. Consequently, Foran also does not teach the steps recited in claims 9 in the order recited (e.g. step (d) depending upon steps (a),(b) and (c) and thus commencing later).

If the teachings of Foran were added to those of Watkins, the combination might use the mask of Foran in lieu of the mask of Watkins. However, there is no indication in Foran that the order in which the masks would be generated should be different from the order described in Watkins. Consequently, the combination of Watkins and Foran would still scan convert the polygons in essentially the same manner. In other words, the combination would still determine the intersections of a particular polygon with pixel(s) of the display, and provide the mask(s) for the polygon. The next polygon would then be scan converted. Consequently, one or more of the masks associated with a pixel might be provided after mask(s) for other pixel(s) are provided. The method recited in claim 1, in contrast, would determine all of the intersections with polygons for a particular pixel and determine the mask(s) for the particular pixel, before then move to the next pixel. Watkins in view of Foran, therefore, do not teach or suggest steps (a)-(e) performed in a particular order and/or depending upon previous steps (such as (d) depending upon steps (a)-(c)). Thus,

Watkins in view of Foran cannot teach or suggest the method recited in claim 1. Accordingly, Applicant respectfully submits that claim 1 is allowable over the cited references.

The Examiner's citation of sections in Watkins (col. 8, line 36) and Foran (col. 5, line 16) does not change this conclusion. The portion of Watkins cited is merely a description of the problem faced by Watkins. Consequently, the portion cited states that a "test [described above] affords an exceeding simple approach to the resolution of pixel-by-pixel or sub-pixel by sub-pixel polygon priority." Watkins, col. 8, lines 34-36. In other words, the cited portion of Watkins merely indicates that scan conversion performed polygon by polygon by the system of Watkins can solve the problem of resolving different polygons at the pixel or subpixel level. Similarly, the portion of Foran cited by the Examiner describes some of the operations performed by the raster subsystem of Foran. Foran, col. 5, lines 10-18. These operations are thus performed *after* the polygons have been scan converted by the system of Foran. As described above, it is the scan conversion of polygons that provides the masks and determines the intersections of polygons with pixels on a polygon by polygon basis. Consequently, the cited portions of Watkins and Foran do not change the conclusion above, that Watkins in view of Foran neither teach nor suggest the method recited in claim 1.

Claim 2 depends upon independent claim 1. Consequently, the arguments herein apply with full force to claim 2. Accordingly, Applicant respectfully submits that claim 2 is allowable over the cited references.

The Examiner also rejected claims 3 and 5-8 under 35 U.S.C. § 103 as being unpatentable over Watkins in view of Foran in further view of Kuchkuda.

Claims 3 and 5-8 depend upon independent claim 1. Consequently, the arguments herein with respect to Watkins and Foran apply with full force to claims 3 and 5-8. In particular, Watkins in view of Foran fails to teach or suggest processing certain data for a subsequent pixel after data is processed for all of the objects intersecting the current pixel, the result of which allows objects to be rendered pixel by pixel rather than object by object.

Kuchkuda fails to remedy the defects of Watkins in view of Foran. In particular, the cited portions of Kuchkuda fail to mention performing a method for antialiasing including the steps of determining intersections of objects with a current position, providing masks for the objects intersecting the current pixel and performing antialiasing for all the objects intersecting a current position before performing these steps for another position. Consequently, any method or system made using the teachings of Watkins in view of Foran in further view of Kuchkuda would fail to mention performing a method for antialiasing including determining intersections of objects with a current position, providing masks for the objects intersecting the current position and performing antialiasing for all the objects intersecting the current position before performing these steps for another position. Thus, Watkins in view of Foran in further view of Kuchkuda cannot teach or suggest step (e) of claim 1. Accordingly, Applicant respectfully submits that claims 3, 5-8 and 12-15 are allowable over the cited references.

The Examiner also rejected claims 10-15 under 35 U.S.C. § 103 as being unpatentable over Watkins in view of Foran in further view of Eckart.

Applicant respectfully traverses the Examiner's rejection. Claim 10 recites the use of a display, a processor block, an interpolator and means for utilizing masks provided by the interpolator to perform antialiasing ("antialiasing means"). Claim 10 recites that the processor

block determines the intersections of all of the polygons intersecting a particular pixel and provides the corresponding output before providing a similar output for subsequent pixels. Thus, the processor bock determines the intersection pixel by pixel. In addition, claim 10 recites that the interpolator, which provides masks for the objects, renders the objects pixel by pixel in raster order. Thus, claim 10 is analogous to claim 1 in that the determinations of intersections (by the processor block) and the providing of masks (by the interpolator) are performed pixel by pixel instead of polygon by polygon. Consequently, the arguments herein with respect to Watkins and Foran apply with full force to claim 10. In particular, Watkins and Foran fail to teach or suggest a system in which the processor block provides the output for all object(s) intersecting the current position before providing an output for any object intersecting a subsequent position. Watkins and Foran also fail to teach or suggest a system in which the interpolator and antialiasing means render the frame position by position in raster order.

Eckart fails to remedy the defects of Watkins and Foran. Eckart fails to teach or suggest a system in which the processors determine intersections with pixels and provide an output on a pixel by pixel basis. Eckart describes a system including processors PP_1-PP_N, a cross bar, blending processors BP_1-BP_M and a frame buffer. Eckart states that the display receives the data pixel by pixel in raster order. Eckart, col. 4, lines 65-67. However, This is due to the presence of frame buffer. Eckart, col. 4, lines 64-65. Eckart explicitly states that the data from the processor PP_1-PP_N are organized based on primitives. Eckart, col. 6, lines 27-30. The processors PP1-PPN of Eckart correspond to the processor block of claim 1 because these processors of Eckart provide an output for specific pixels which the object, or primitive, intersects. There is no indication that the

processors of Eckart determine intersections with polygons or provide the data in any particular order.

Because the output of the processors PP1-PPN of Eckart is not pixel by pixel, the crossbar of Eckart is used to ensure that the data flows from the processors to appropriate blending processor, which are organized based on position in the screen (i.e. based on position). Eckart, col. 6, lines 33-36. This is in contrast to the recited processor block, which outputs all of the data for objects intersecting the current position before providing data for objects intersecting subsequent position.

Applicant can also find no indication in Eckart that masks are provided by any component in any particular order. This is contrast to the interpolator and processing block of claim 10, which render data position by position. Consequently, Eckart also fails to teach or suggest this feature.

If the teachings of Eckart were added to those of Watkins and Foran, the combination might use the crossbar or Eckart in order to ensure that data flows from the scan conversion system of Watkins and Eckart to the appropriate location. However, mask generation would still be performed as in Watkins and Foran. Even if the processor block PP1-PPN of Eckart were used in lieu of the scan converter of Watkins and Foran, the combination would still fail to determine intersections and masks on a per pixel basis. Eckart, therefore, does not remedy the defects of Watkins and Foran. Watkins in view of Foran in further view of Eckart cannot, therefore, teach or suggest the system recited in claim 10. Accordingly, Applicant respectfully submits that claim 10 is allowable over the cited references.

Claims 11-13 and 15 depend upon independent claim 10. Consequently, the arguments herein apply with full force to claims 11-13 and 15. Accordingly, Applicant respectfully submits that claims 11-13 and 15 are allowable over the cited references.

Accordingly, for the above-mentioned reasons, Applicant respectfully submits that the claims are allowable over the cited reference. Consequently, Applicant respectfully requests reconsideration and allowance of the claims as currently presented.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made"**.

Applicant's attorney believes that this application is in condition for allowance. Should any unresolved issue remain, the Examiner is invited to call Applicant's attorney at the telephone number indicated below.

Respectfully submitted,

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Date

Janyce R. Mitchell
Attorney for Applicant
Reg. No. 40,095
(650) 493-4540

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

1. (Thrice amended) A method for generating a graphical image on a display from data describing at least one object, the display including a plurality of positions, each of the plurality of positions having an area, the method comprising the steps of:

(a) determining if a portion of an object of the at least one object intersects a current position of the plurality of positions and providing an output if the portion intersects the current position;

(b) providing a mask for the portion if it is determined that the portion intersects the current position, the mask indicating an extent to which the portion occupies the area of the current position;

(c) using the mask to provide antialiasing for the portion at the current position;

(d) repeating steps (a)-(c) for each remaining object of the at least one object at the current position; and

(e) repeating steps (a) through (d) for each remaining position of the plurality of positions once step (d) is performed for the current position;

thereby allowing the graphical image to be rendered position by position;

wherein each of the plurality of positions is a pixel and wherein the current position is a current pixel on the display.

Please cancel claim 4.

5. (Amended) The method of claim [4]1 further comprising the step of:

(f) removing the portion if the portion is obstructed.

10. (Twice amended) A system for generating a graphical image on a display from data describing at least one object, the system comprising:

a display including a plurality of positions, each of the plurality of positions having an area;

a processor block coupled with the display, the processor block for determining if a portion of each of the at least one object intersects a current position of the plurality of positions and providing an output if the portion intersects the current position;

an interpolator coupled with the processor block, the interpolator for interpolating the data and providing a mask for the portion, the mask indicating an extent to which the portion occupies the area of the current position; and

means for utilizing the mask to provide antialiasing;

wherein the at least one object are rendered by the interpolator and the mask utilizing means position by position in raster order; and

wherein the processor block provides the output for all of the at least one object intersecting the current position before providing an output for any of the at least one object intersecting a subsequent position;

wherein each of the plurality of positions is a pixel and the current position is a current pixel.

Please cancel claim 13.

14. (Amended) The system of claim [13]10 further comprising:

means for sorting each of the at least one portion based on the z-value.